Income Taxes and Entrepreneurship

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Motivation

- US entrepreneurs actively managing businesses:
  - Have higher average incomes than paid-employed peers — Income Profiles
  - Run firms generating most US business net income — Net Income

⇒ Central role in income tax debates

Challenges

- US entrepreneurs actively managing businesses:
  - Report only half of their taxable income — Cheating
  - Create business value through off-book intangible investments — Intangibles

⇒ Not easy to analyze

This Paper

- Develops theory with occupational choice and business *sweat* capital
- Parameterizes baseline model using US NIPA and administrative tax data
- Estimates optimal income tax rates with transitional dynamics

Theory

Environment

- Two business sectors:
  - Actively-managed businesses (eg, pass-throughs)
  - All other businesses (eg, C-corporate plus government enterprises)
- Households
  - Endowed with stochastic abilities
  - Face occupational choice in self- or paid-employment
- Government
  - Revenues from taxes on incomes and consumption
  - Expenditures on goods and services and transfers

Occupational Choice

- Choose employment (w) or entrepreneurship (b)

$$v(a,\kappa,s,\xi) = \max_{d\in\{0,1\}} \; d\{v^w(a,\kappa,s)+\xi\} + (1-d)v^b(a,\kappa,s)$$

where

d = occupational choice

v = pre-choice value function

v^o = value function with occupation $o = w, b$

a = financial assets

κ = sweat capital (customer-bases, tradenames, etc)

s = shocks to productivity in self- and paid- employment

ξ = occupational taste shock

Owners' Dynamic Program

- Choose consumption, factor inputs, next period assets

$$v^b(a,\kappa,s) = \max\ \{u(c) - \vartheta(e) + \beta E[v(a',\kappa',s',\xi')]\}$$

$$\begin{aligned} \text{s.t.}\quad a' &\le (1+r)a + (1-\tau_b)\pi + tr - (1+\tau_c)c \ge 0 \\ \kappa' &\le (1-\delta_\kappa)\kappa + e \\ \pi &= zf(\kappa, k_b, n_b) - (r+\delta_k)k_b - wn_b \\ k_b &\le \chi a \end{aligned}$$

where

$$\begin{aligned} c &= \text{consumption} \\ e &= \text{time for building sweat capital} \\ \pi &= \text{business profits} \\ z &= \text{shock to business productivity} \in s \\ k_b &= \text{tangible capital rented by businesses} \\ n_b &= \text{workers hired by businesses} \\ \tau_b, \tau_c &= \text{tax rates} \end{aligned}$$

Owners' Dynamic Program (Dentist)

- Choose consumption, factor inputs, next period assets

$$v^b(a, \kappa, s) = \max \{u(c) - \vartheta(e) + \beta E[v(a', \kappa', s', \xi')]\}$$

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where

$$\begin{aligned} c &= \text{consumption} \\ e &= \text{time for building patient list } (\kappa) \\ \pi &= \text{business profits} \\ z &= \text{shock to business productivity} \in s \\ k_b &= \text{rented dental office and equipment} \\ n_b &= \text{dental hygienists} \\ \tau_b, \tau_c &= \text{tax rates} \end{aligned}$$

Workers' Dynamic Program

- Choose consumption and next period financial assets

$$v^w(a,\kappa,s) = \max \{u(c) + \beta E[v(a',\kappa',s',\xi')]\}$$

$$\text{s.t.} \quad a' \leq (1+r)a + (1-\tau_w)w\epsilon\bar{n} + tr - (1+\tau_c)c \geq 0$$

$$\kappa' \leq (1-\lambda)\kappa$$

where

c = consumption

κ = sweat capital from previous business ownership

$\bar{n}$ = fixed time at work

ϵ = shock to work productivity $\in s$

τ_w, τ_c = tax rates

Workers' Dynamic Program (Dentist)

- Choose consumption and next period financial assets

$$v^w(a,\kappa,s) = \max\ \{u(c) + \beta E[v(a',\kappa',s',\xi')]\}$$

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$$\kappa' \leq (1-\lambda)\kappa$$

where

c = consumption

κ = patient list from previous business ownership

$\bar{n}$ = time as employee at another dental office

ϵ = shock to work productivity $\in s$

τ_w, τ_c = tax rates

Corporate Sector

- Choose hours and investment

$$v^c(k_c) = \max \left\{(1-\tau_d)d_c + \left(\frac{1}{1+r}\right) v^c(k_c')\right\}$$

$$\text{s.t.} \quad k_c' \leq (1-\delta_k)k_c + x_c \geq 0$$

$$y_c = AF(k_c, n_c)$$

$$d_c = y_c - wn_c - x_c - \tau_p(y_c - wn_c - \delta_k k_c)$$

where

n_c = hours

x_c = investment

y_c = output

d_c = dividends

τ_d, τ_p = tax rates

Mutual Funds

- Choose asset holdings to maximize pv of dividends

$$v^m(x) = \max \left\{ d_m + \left(\frac{1}{1+r} \right) v^m(x') \right\}$$

$$\text{s.t.} \quad d_m = qs + b + \int k_b(i)\mu(i)di - \int a(i)\mu(i)di \quad (1)$$

$$+ (1-\tau_d)d_c s + rb + (r+\delta_k)\int k_b(i)\mu(i)di - r\int a(i)\mu(i)di \quad (2)$$

$$- [qs' + b' - \int a'(i)\mu(i)di] - \int x_b(i)\mu(i)di \quad (3)$$

where

(1) = net worth of shares, bonds, fixed assets less deposits, beginning of period
(2) = financial income earned during the period
(3) = new deposits less investments in shares, bonds, fixed assets, end of period

Competitive Equilibrium

- Given initial conditions $\{a_{i,-1}, \kappa_{i,-1}, s_{i,0}\}_{i\in[0,1]}$, a CE consists of
  - Factor prices $\{r_t, w_t\}_{t\geq 0}$
  - Individual choices $\{c_{it}, a_{it}, \kappa_{it}, d_{it}, k_{b,it}, n_{b,it}\}_{t\geq 0, i\in[0,1]}$
  - Corporate choices $\{k_{ct}, n_{ct}\}_{t\geq 0}$
  - Fiscal variables $\{G_t, T_t, B_t, \tau_{ct}, \tau_{wt}, \tau_{bt}, \tau_{pt}\}_{t\geq 0}$

- Given the prices and policies:
  - Individual choices solve individual optimality
  - Corporate choices maximize profits
  - Government budget holds
  - Markets clear

Computation

Some Challenges

- Want to compute transition dynamics and optimal taxes
- Need to deal with
  - Large state space with two endogenous states
  - Discrete occupational choice
  - Long transition periods

Addressing the Challenges

- Want to compute transition dynamics and optimal taxes
- Developed
  - Variant of EGM algorithm on 2-dimensional grid (EGM)
  - Approximation method for transition dynamics with discrete choice (Transitions)
  - Memory-saving techniques for long transitions (need $T > 500$)

Calibrating the Model

Calibrating the Model

- Macro moments (easy)
  - National income and product accounts (BEA)
  - Aggregate tax data (IRS)

- Micro moments (harder)
  - Surveys of business owners (Census)
  - Tax filings of business owners (IRS)

Key Parameters

- Tax rates on incomes, τ_{bt}, τ_{wt}
  - Audits reveal significant business underreporting/overexpensing: τ_{b0}=20%
  - Third-party reporting leaves few options for workers: τ_{w0}=37%
- Productivity processes, $\{z_t, \epsilon_t\}$
  - Calibrated to match business income share and business income growth moments
- Sweat capital deterioration/accumulation, λ, $\vartheta(e) = \omega e^{\eta}/\eta$
  - Identified through exit hazard rates of business owners
- Collateral constraint, $k_b \leq \chi a$
  - Chosen to match S corporation and partnership loans to GDP

Targeted Business Income Moments

- Log productivity governed by:

$$\ln z_{t+1} = \rho_z \ln z_t + \varepsilon_{z,t+1}, \quad |\rho_z| < 1$$

- Three calibration targets from IRS study†

  1. Top 10% of business owners earn 70% of total business income
  2. Distribution of business income growth Distribution
  3. Rank autocorrelation of business income growth: -0.18

$\Rightarrow$ Right-skewed innovations ε_z generate both 1) and 2)

† Bhandari et al. (2025), "On the Nature of Entrepreneurship"

Business Productivity with Right-skewed Innovations

- Log productivity governed by:

$$\ln z_{t+1} = \rho_z \ln z_t + \varepsilon_{z,t+1}, \quad |\rho_z| < 1.$$

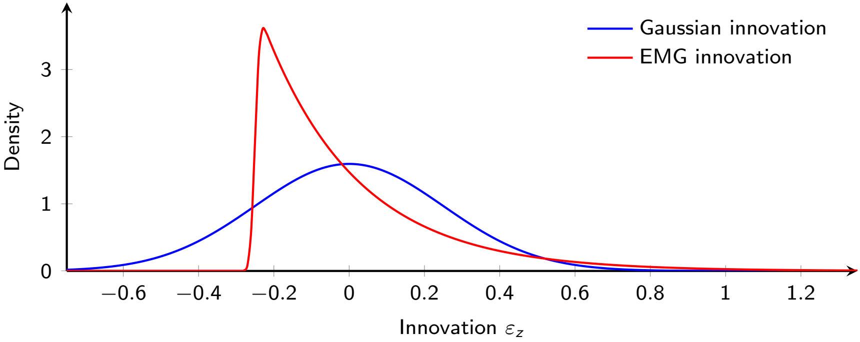
- Innovation ε_{zt} is exponentially modified Gaussian (EMG):

$$\varepsilon_{zt} = \mu_z + \sigma_z Y_t + \zeta_t,$$

where

  - $Y_t \sim \mathcal{N}(0,1)$: routine, symmetric shocks
  - $\zeta_t \sim \text{Exp}(\lambda_z)$: rare, positive shocks
  - $Y_t \perp \zeta_t$

Right-Tailed Productivity Innovations



- Innovations are mean zero with the same variance
- EMG innovations have **much thicker right tail**
- EMG generates realistic upper tails in productivity and firm-size

Macro Moments: BEA

National Income and Product	Model	Data	Government Budget	Model	Data
GDP shares	100	100	Expenditures (% of GDP)	27.2	26.2
Consumption	66.8	66.7	Transfers	20.6	19.7
Investment	29.1	29.2	Net interest	2.5	2.5
Defense	4.1	4.1	Defense	4.1	4.1
GDI shares	100	100	Revenues (% of GDP)	27.2	26.2
Sweat income	9.0	9.0	Taxes on income	23.2	22.2
Compensation	45.5	46.2	Taxes on consumption	4.0	4.0
Capital income	45.5	44.8			

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Macro Moments: IRS

- Combine S-corporation and partnership debt liabilities:
  - Mortgages, notes, bonds payable (short- and long-term)
  - Nonrecourse loans
  - Loans from shareholders
  - Loans from partners

$\Rightarrow$ 39.8% of GDP in data compared to 42.1% in model

Micro Moments: Business Income

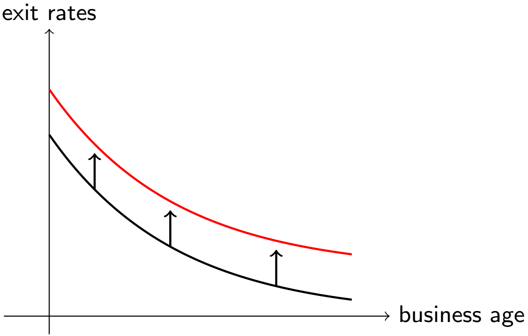
		Model	Data
Profit share	Top 10%	0.62	0.70
Profit growth	10^{th} percentile	$-$ 0.69	-0.54
	25^{th}	$-$ 0.57	-0.20
	50^{th}	$-$ 0.32	0.02
	75^{th}	0.29	0.32
	90^{th}	1.77	1.09
	Autocorrelation	$-$ 0.14	-0.18

Micro Moments: Business Entry/Exit

	Model	Data
Entry rate, average	0.03	0.02
Exit rates		
By business age, ≤ 1	0.36	0.37
2–6	0.21	0.19
> 6	0.11	0.11
all	0.24	0.21

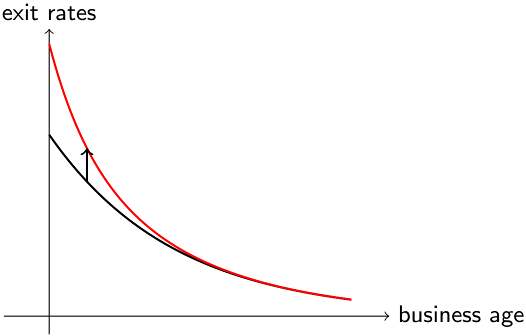
Decline in Sweat Deterioration in Paid Work, λ

- λ affects overall level of exit rates



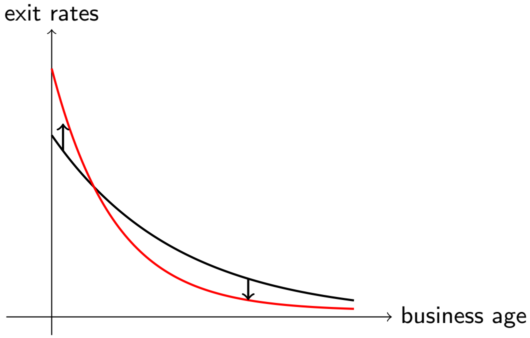
Increase in Scale Parameter of $\vartheta(e) = \omega e^{\eta}/\eta$

- ω affects initial exit rates



Increase in Curvature Parameter of $\vartheta(e) = \omega e^{\eta}/\eta$

- η affects how steeply exit rates decline with business age



Identification of Key Parameters

	Parameters			Exit rate		
	λ	ω	η	Age ≤ 1	Age 2–6	Age >6
Baseline	1.00	0.50	1.75	0.36	0.21	0.11
Low λ	0.06	0.50	1.75	0.57	0.45	0.43
Low ω	1.00	0.10	1.75	0.43	0.22	0.11
High ω	1.00	2.00	1.75	0.32	0.22	0.10
Low η	1.00	0.50	1.50	0.34	0.22	0.18
High η	1.00	0.50	2.25	0.43	0.24	0.05
Fixed sweat				0.58	0.53	0.53

where

- λ = sweat deterioration in paid work
- $\vartheta(e)$ = disutility of effort = $\omega e^{\eta}/\eta$

Parameters

Parameter	Description	Value
Preferences		
σ	Risk aversion	2
ω	Disutility of sweat building scale	0.50
η	Disutility of sweat building curvature	1.75
β_o	Unadjusted discount factor	0.99
γ	Economic growth rate (%)	2
β	Growth adjusted discount factor	0.97
Private Business		
χ	Collateral requirement	5
o	Sweat capital share in production	0.30
ϕ	Physical capital share	0.29
ν	Labor share	0.41
δ_κ	Owner sweat depreciation (%)	5.8
λ	Worker sweat depreciation (%)	100
Other Business		
A	Corporate TFP	0.71
α	Capital share in corporate production	0.53
δ_k	Tangible capital depreciation (%)	4.1

Parameter	Description	Value
Taxes		
τ_b	On business income	0.20
τ_w	On labor income	0.37
τ_c	On consumption	0.06
τ_p	On corporate profits	0.20
Government Spending		
tr	Lump-sum transfer	0.68
G	Government spending	0.14
B	Government debt	3.40
Income Shocks		
ρ_z	Persistence of $\ln z$	0.64
σ_z	EMG std. dev. of Gaussian innovation	0.01
λ_z	EMG tail parameter of Exponential	4
ρ_ϵ	Persistence of $\ln \epsilon$	0.74
σ_ϵ	Std. dev. of Gaussian innovation	0.18
Taste Shocks		
σ_ξ	Scale of Gumbel shocks	0.03

Model Predictions

Model Predictions

- Results:
  - Transitions with $\tau_b = 40\%$ in new steady state
  - Optimal τ_b^* and consumption-equivalent welfare gains

- Two economies:
  - Sweat capital fixed
  - Sweat capital variable

Transitions, τ_b: 20%$\rightarrow$ 40%

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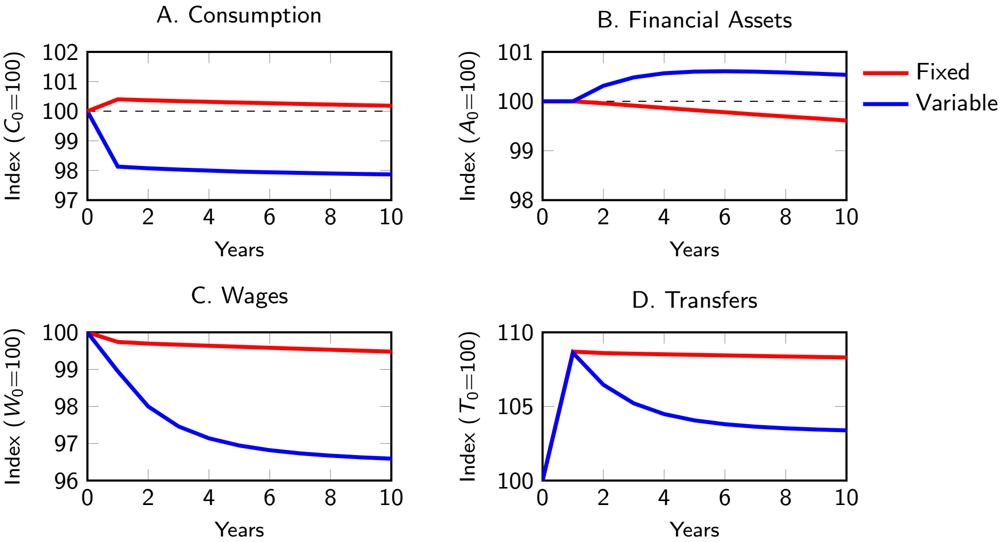
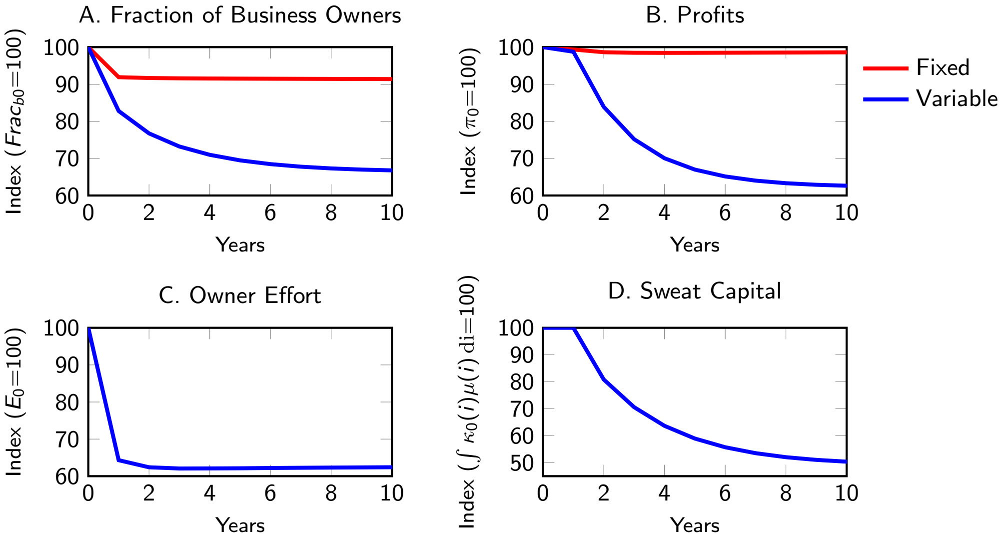


Transitions, τ_b: 20%$\rightarrow$ 40%



Business Tax Elasticity

- Recent empirical finding (Goodman et al. 2024)
  - Section 199A reduced effective tax for *some* pass-throughs
  - Estimated 2-year tax elasticity ($\%\Delta\pi_b/\%\Delta(1-\tau_b)$) is 0.75
- Our theoretical finding
  - Tax rate τ_b doubled (to equal statutory)
  - Estimated 2-year tax elasticity is 0.64
  - Main groups contributing:
    - Mature large firms on extensive margin
    - Entrants in year of reform on intensive margin

Optimal Taxation

Optimal Taxation

- Current US system:
  - Weak enforcement of private business
  - Low effective rates on owner profits
- Primary concerns motivating reforms:
  - Too little insurance and redistribution
  - Misallocated resources
  - Distorted entry and investment

Optimal Taxation

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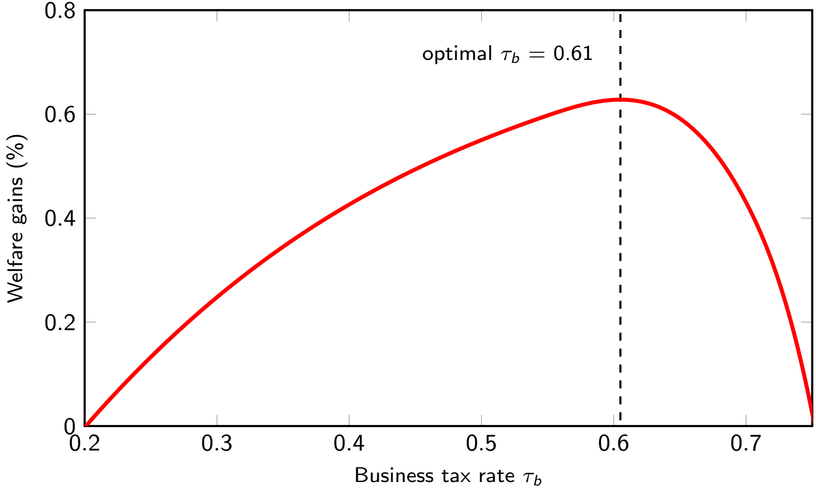
Let's consider the fixed- and variable-sweat economies in turn

Welfare in Fixed-Sweat Economy



Welfare in Fixed-Sweat Economy

- Results similar to
  - Theoretical studies of canonical firm dynamics model (Lucas 1978)
  - Quantitative studies of taxing entrepreneurs (Bruggemann 2021 and Imrohoroglu et al. 2023)

- With inelastic responses and high optimal taxes

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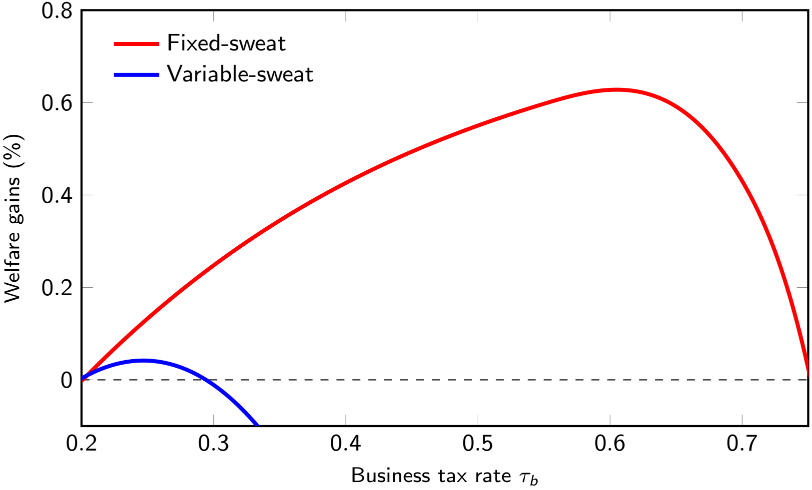
Next consider the variable-sweat economy

Welfare in Variable-Sweat Economy, $\tau_b^* = 25$ percent



Welfare in Variable-Sweat Economy

- Optimum is well below the fixed-sweat economy
- Welfare gain is 0.04% at $\tau_b^* = 25\%$ versus 0.63% at $\tau_b^* = 61\%$ in fixed-sweat economy
- Key reason is higher elasticity of business activity in variable-sweat model

Role of Transition Dynamics

- Optimum with transition dynamics
  - Gain of 0.04%
  - Tax rate of 25%
- Optimum without transition dynamics
  - Gain of 0.87%
  - Tax rate of 48%

Role of Transition Dynamics

- Optimum with transition dynamics
  - Gain of 0.04%
  - Tax rate of 25%

- Optimum without transition dynamics
  - Gain of 0.87%
  - Tax rate of 48%

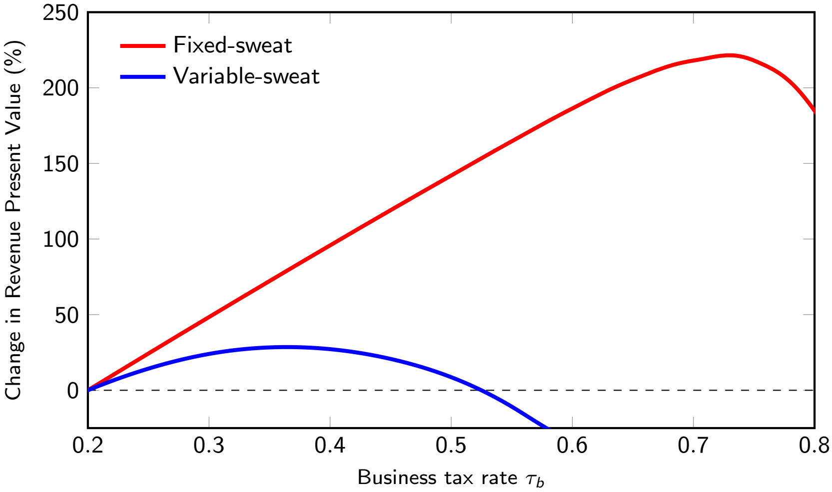
$\Rightarrow$ Steady state analysis overstates the welfare gain and the optimal tax rate

Laffer Curve of Business Tax Revenue

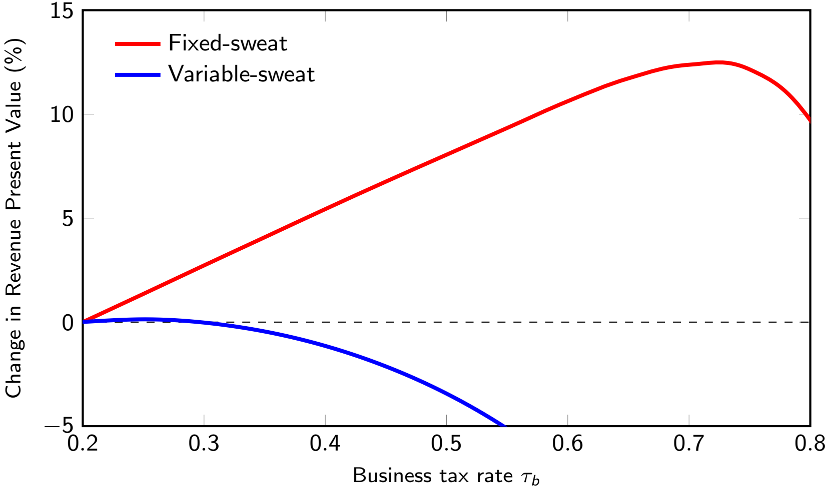
- Another perspective on tax elasticities
  - How much revenue can be raised?
  - How targeted can tax policy be?

$\Rightarrow$ Look at the Laffer curves

Laffer Curve of Business Tax Revenue



Laffer Curve of Total Tax Revenue



Role of Collateral Constraints

- Vary χ in $k_b \leq \chi a$
- Predicted loan shares:

χ	Loan-to-GDP (%)
3	27.3
5	42.1
10	59.7
∞	78.5

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- Predicted loan shares:

χ	Loan-to-GDP (%)
3	27.3
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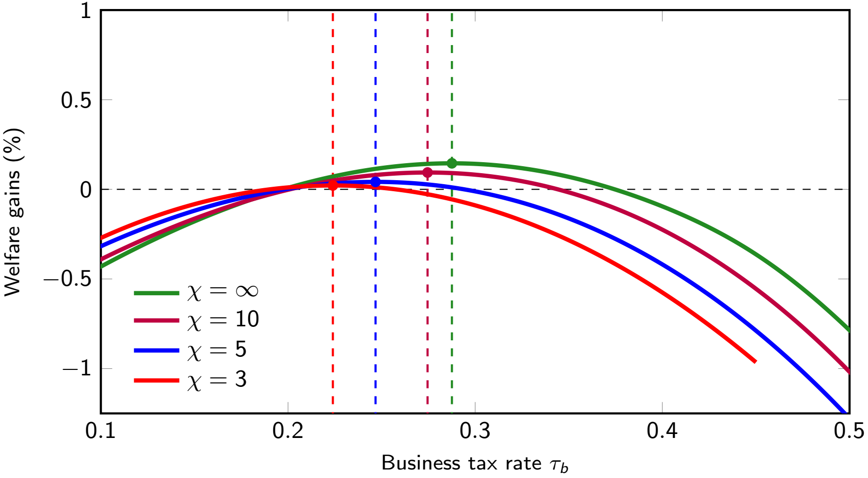
∞	78.5

- How does the optimal tax change?

Main Results Robust to Varying χ



Summary

- Optimal rate of 25% is
  - Somewhat higher than current effective rate in US
  - Significantly different from estimates in literature

- Quantitative role of
  - Variable sweat capital is consequential
  - Transitional dynamics are consequential
  - Collateral constraints are inconsequential

Appendix

Income Profiles

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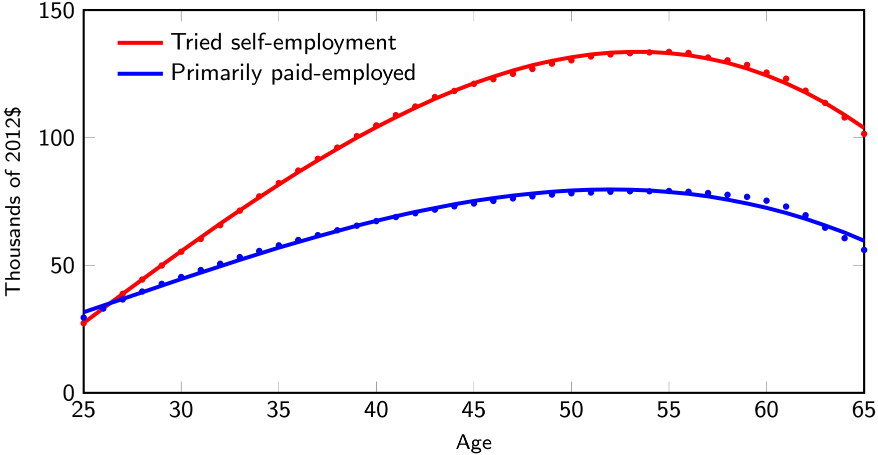

Source: Bhandari et al. (2025), "On the Nature of Entrepreneurship"

Risk

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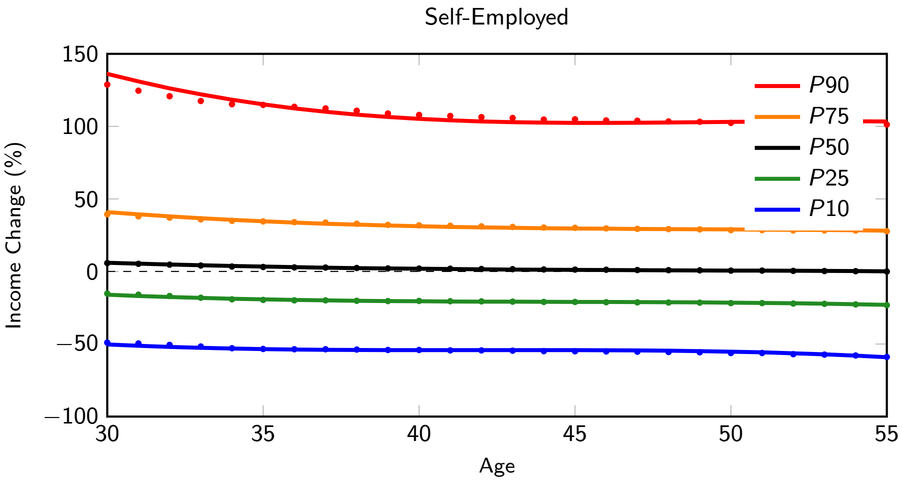

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Growth in Pass-Throughs

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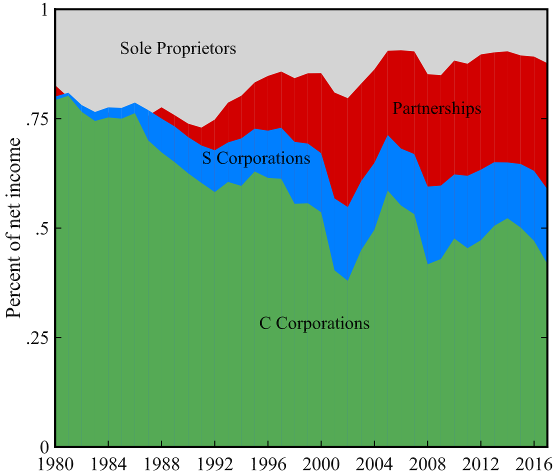

Source: IRS Integrated Business Data

Section 197 Intangibles

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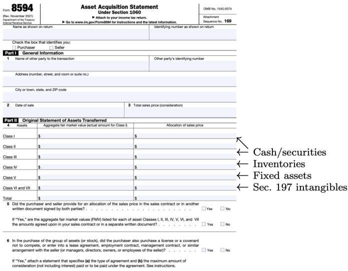
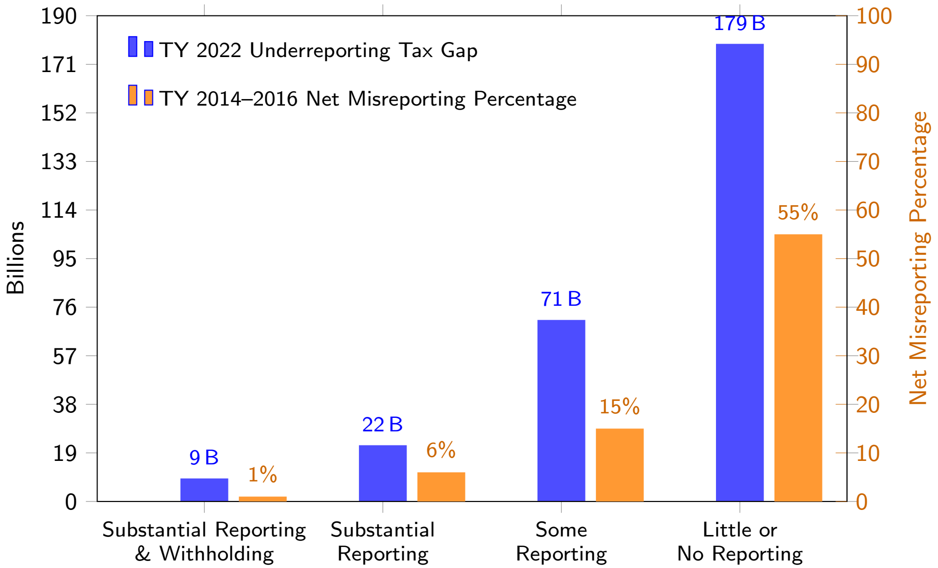
- Most capital is **not observable until transferred**
- Transferred assets are primarily **intangible** (from Form 8594 $\approx$ 70%)
  - Customer bases and client lists, non-compete covenants
  - Trademarks and tradenames
  - Licenses and permits
  - Workforce in place
  - Goodwill and going concern value
- Assets are **sold as a group**
- Sale **requires time** to find buyers/negotiate (typical from brokered data $\approx$ 7 months)



Source: "Capital Reallocation and Private Firm Dynamics," Bhandari, Martellini, McGrattan (2025)

Less Visibility Leads to Greater Misreporting (Source: IRS)

back



Age Distribution of Businesses

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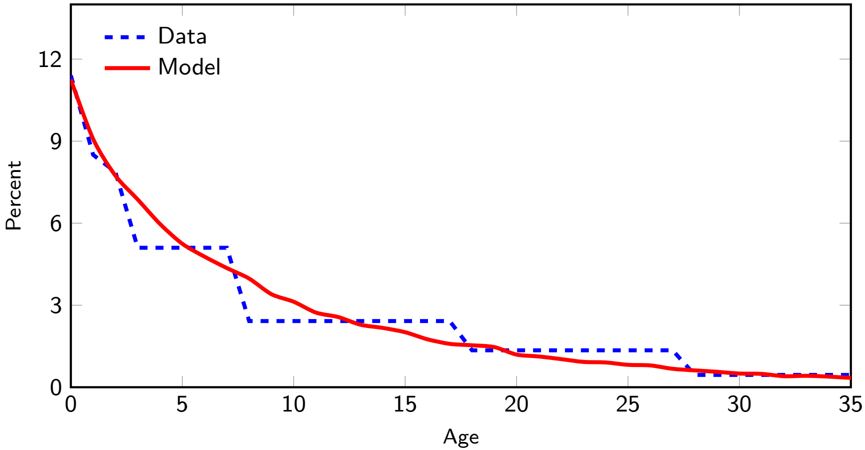

Source: Bhandari and McGrattan (2021), "Sweat Equity in U.S. Private Business"

Distribution of Annualized 3-Year Growth

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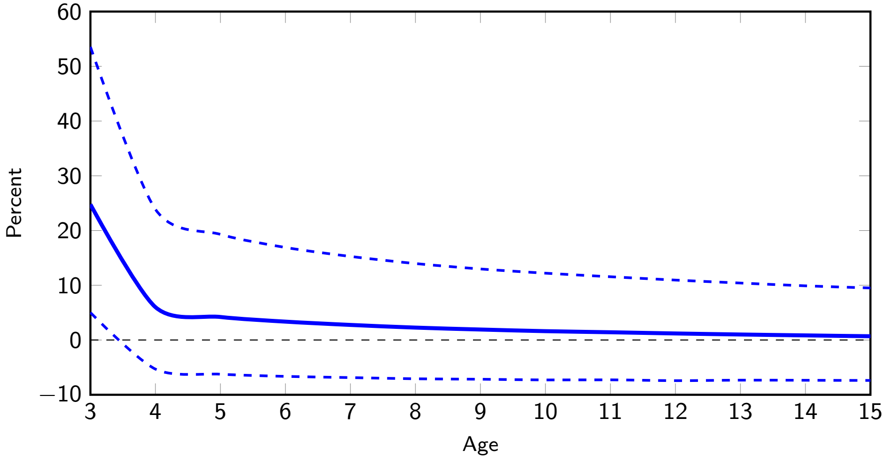

Source: "Capital Reallocation and Private Firm Dynamics," Bhandari, Martellini, McGrattan (2025)

EGM in 2-D

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- Dynamic programming with two endogenous states and a discrete choice
- Standard value-function iterations are very slow
- Overcoming challenges in applying a faster EGM-type method:

  1. Two endogenous states require interpolation over a non-rectangular 2-D grid

  ⇒ Use 1-D interpolation per state variable

  2. Discrete choice implies the FOCs insufficient

  ⇒ Drop non-optimal choices by comparing value functions

Approximating Transition Dynamics

back

- Perturbation method:
  - Stack *all* individual optimality plus market clearing conditions into $\mathcal{F}$
    - Let Z_{-1} = initial aggregate state and distribution over states
    - Let X_t = aggregate variables that are not distributions
    - Let the stacked system be denoted by $\mathcal{F}(\{X_t\}, Z_{-1}) = 0$
  - Add taste shocks with positive variance to handle discrete choice manifold[†]
  - Replace $\mathcal{F}$ with Taylor expansion around *post-reform* steady state
  - Characterize dynamics as sequence of linear systems for *directional derivatives*
  - Pre-compute coefficients of linear systems using final steady state means

$\Rightarrow$ Fast, scalable, and efficient

[†] Bhandari, Evans, McGrattan (2025)

Steady state comparisons, τ_b: 20% $\rightarrow$ 40%

	Variable sweat			Fixed sweat		
	baseline	reform	change (%)	baseline	reform	change (%)
Consumption C	2.22	2.17	-2.3	2.18	2.17	-0.4
Assets A	19.25	19	-1.3	18.52	18.18	-1.8
Wage W	1.55	1.49	-4.2	1.47	1.45	-1.5
Transfer Tr	0.68	0.7	3	0.65	0.7	7.5
Fraction of Owners $frac_b$	0.1	0.07	-31.8	0.07	0.06	-9.7
Owner Effort E	0.05	0.03	-32.1			
Sweat Capital K	0.18	0.1	-45.8			
Profits Π	0.3	0.21	-30.5	0.29	0.29	-0.1

Steady State Takeaways

- Elasticities are much larger with sweat accumulation
- Drop in number of owners is 32% versus 10%
- Drop in business income is 31% versus 0.1%